FIG. 1

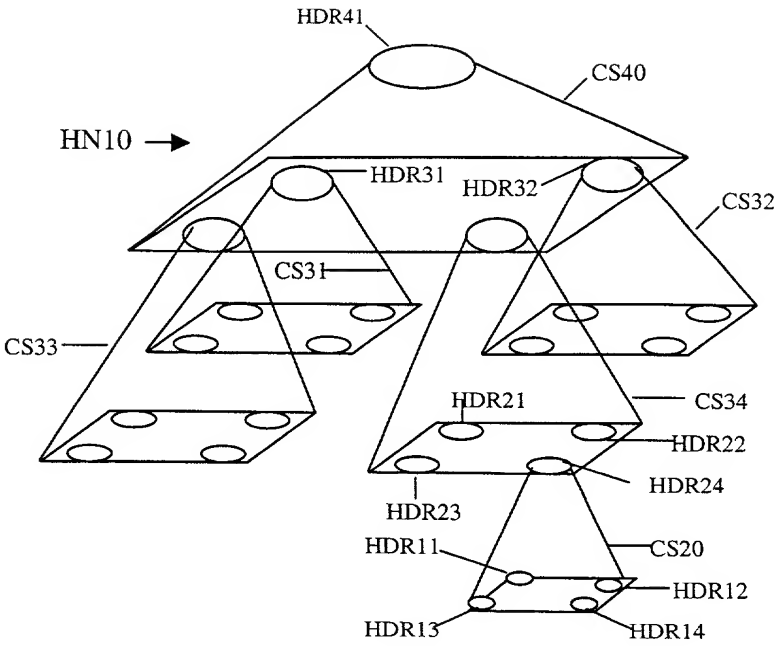
HDR41
CS40
HN10
HDR31
HDR32
CS32
CS31
CS33
HDR21
CS34
HDR22
HDR24
HDR23
HDR11
CS20
HDR12
HDR13
HDR14

FIG. 2

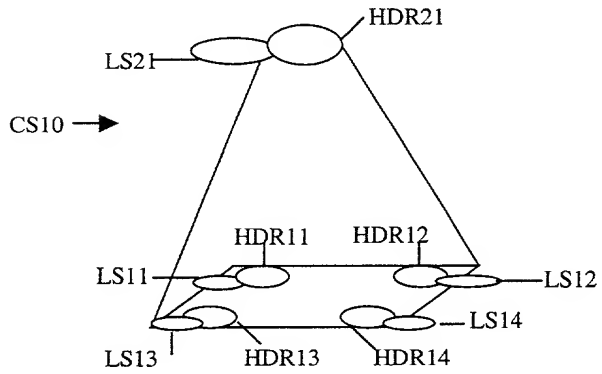
HDR21
LS21
CS10
HDR11
HDR12
LS11
LS12
LS14
LS13
HDR13
HDR14

FIG. 3

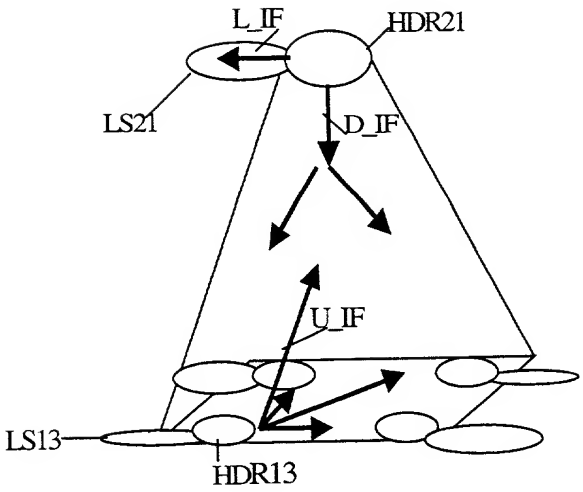
L_IF
HDR21
LS21
D_IF
U_IF
LS13
HDR13

FIG. 4

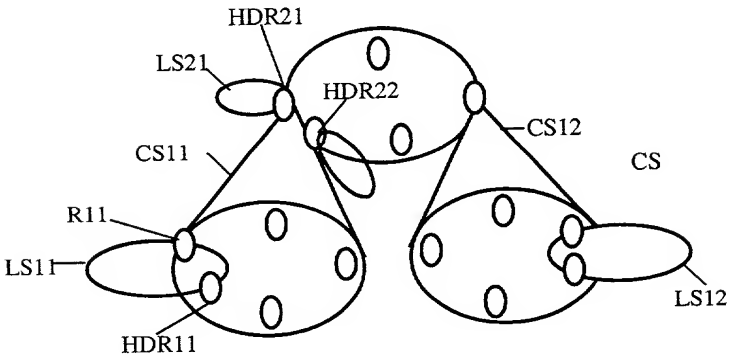
HDR21
LS21
HDR22
CS12
CS11
CS
R11
LS11
LS12
HDR11

FIG. 5

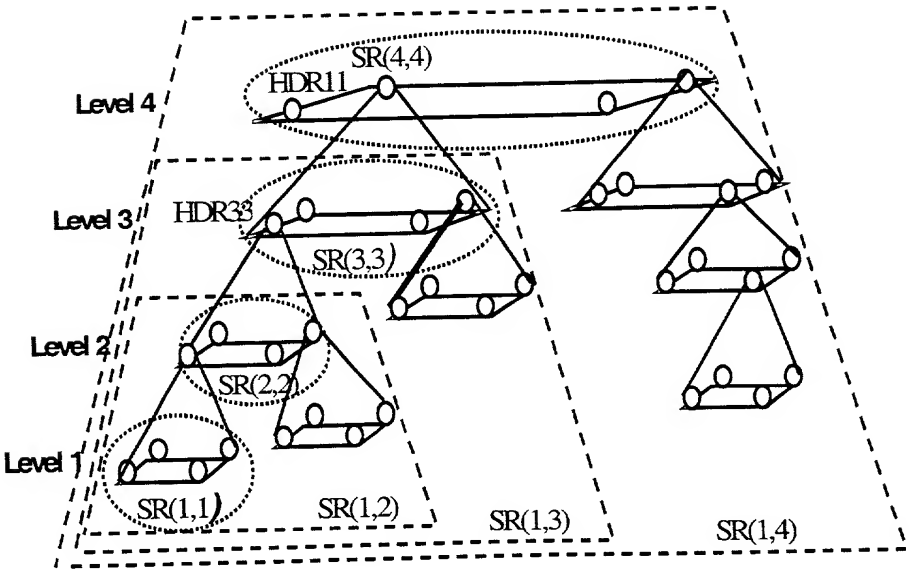
SR(4,4)
HDR11
Level 4
HDR33
Level 3
SR(3,3)
Level 2
SR(2,2)
Level 1
SR(1,1)
SR(1,2)
SR(1,3)
SR(1,4)

FIG. 6

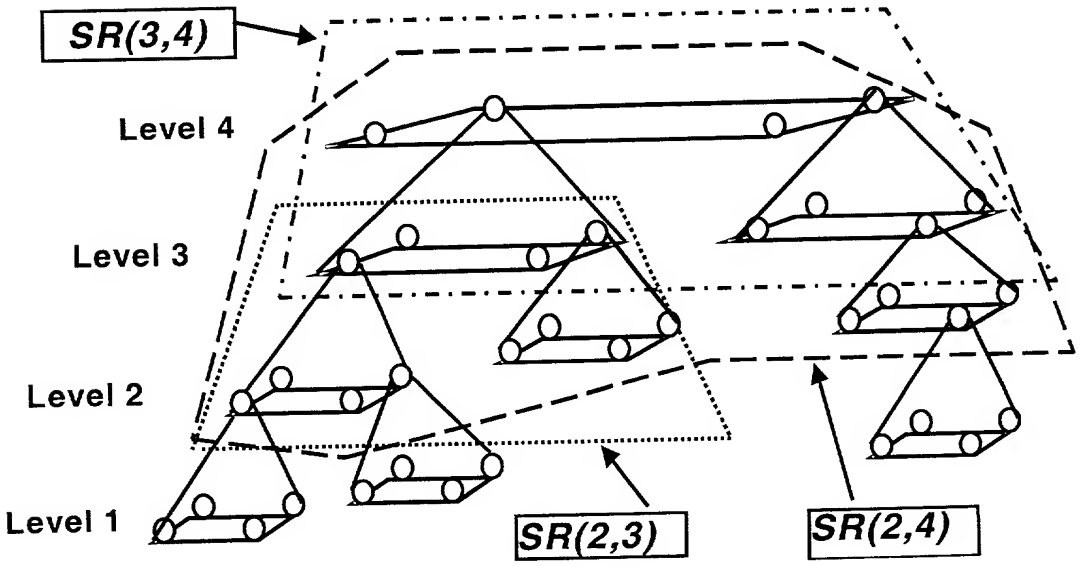
SR(3,4)
Level 4
Level 3
Level 2
Level 1
SR(2,3)
SR(2,4)

FIG. 7

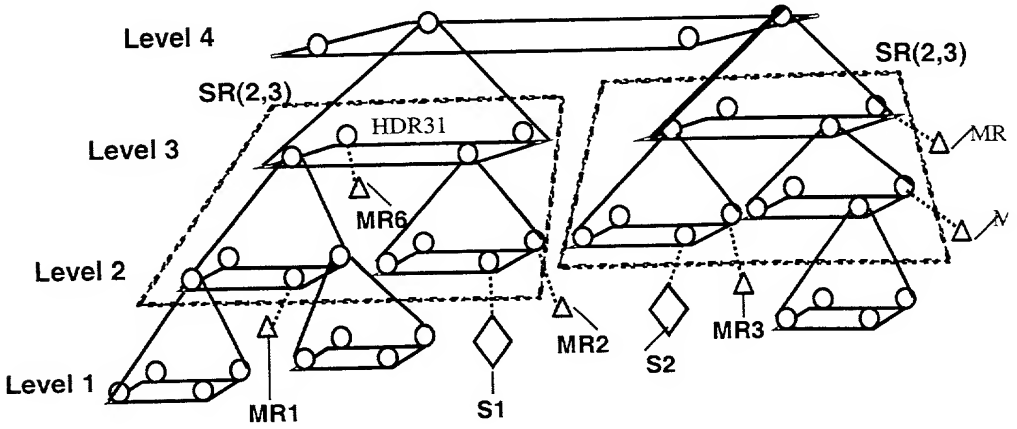
Level 4
SR(2,3)
HDR31
Level 3
MR6
Level 2
Level 1
MR1
S1
MR2
S2
MR3
SR(2,3)
MR

FIG 8

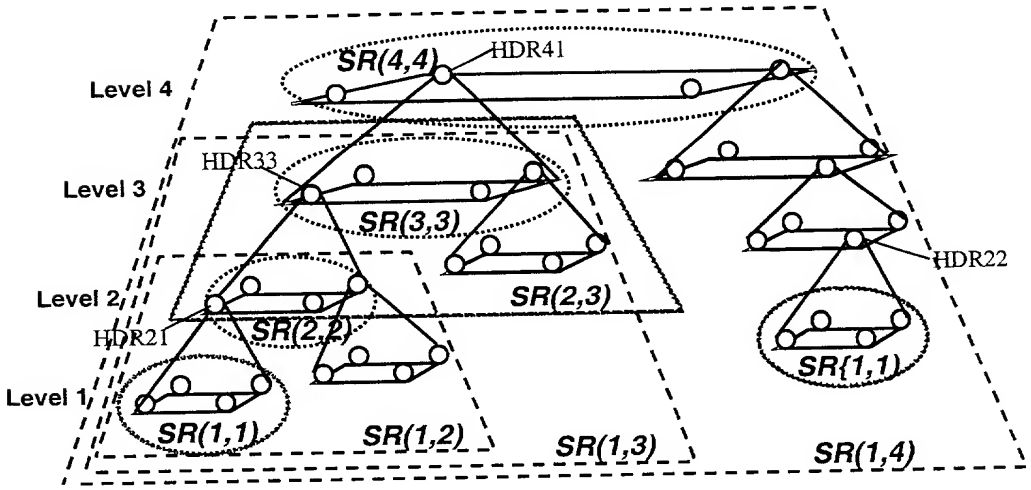
SR(4,4)
HDR41
Level 4
HDR33
Level 3
SR(3,3)
SR(2,3)
HDR22
Level 2
HDR21
SR(2,2)
SR(1,1)
Level 1
SR(1,1)
SR(1,2)
SR(1,3)
SR(1,4)

FIG. 9

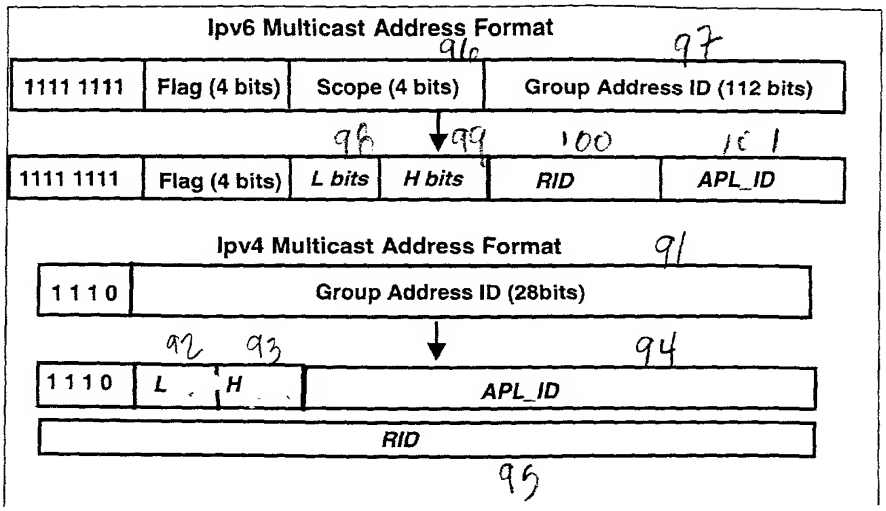
Ipv6 Multicast Address Format
96
97
1111 1111
Flag (4 bits)
Scope (4 bits)
Group Address ID (112 bits)
98
99
100
101
1111 1111
Flag (4 bits)
L bits
H bits
RID
APL_ID
Ipv4 Multicast Address Format
91
1110
Group Address ID (28bits)
92
93
94
1110
L
H
APL_ID
RID
95

FIG. 10

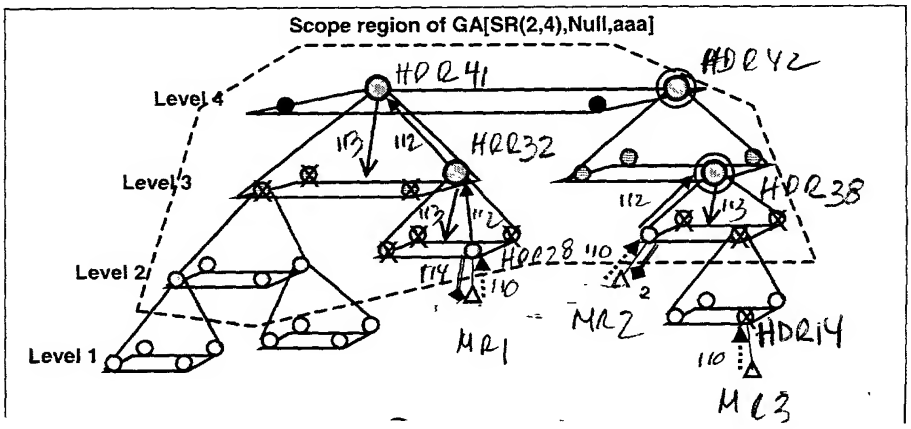
Scope region of GA[SR(2,4),Null,aaa]
Level 4
Level 3
Level 2
Level 1
HDR41
HDR42
HDR32
HDR38
HDR28
HDR14
110
112
113
114
MR1
MR2
MR3

FIG 11

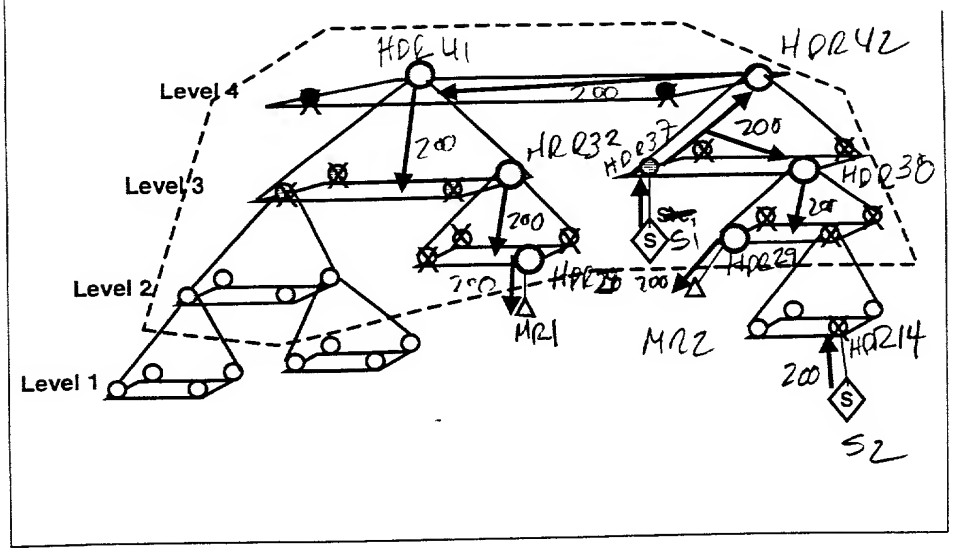
HDR41
HDR42
Level 4
200
200
HDR32
HDR37
HDR38
Level 3
200
200
S
S1
Level 2
HDR29
200
200
HDR25
MR1
MR2
HDR14
Level 1
200
S
S2

FIG 12

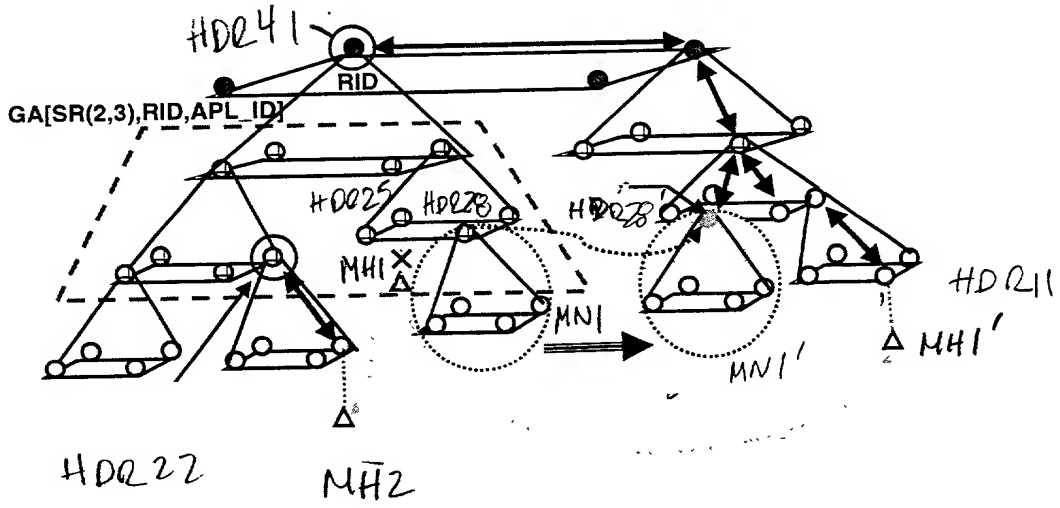
HDR41
RID
GA[SR(2,3),RID,APL_ID]
HDR25
HDR28
HDR28
MH1
MN1
MN1'
HDR11
MH1'
HDR22
MH2

FIG. 13

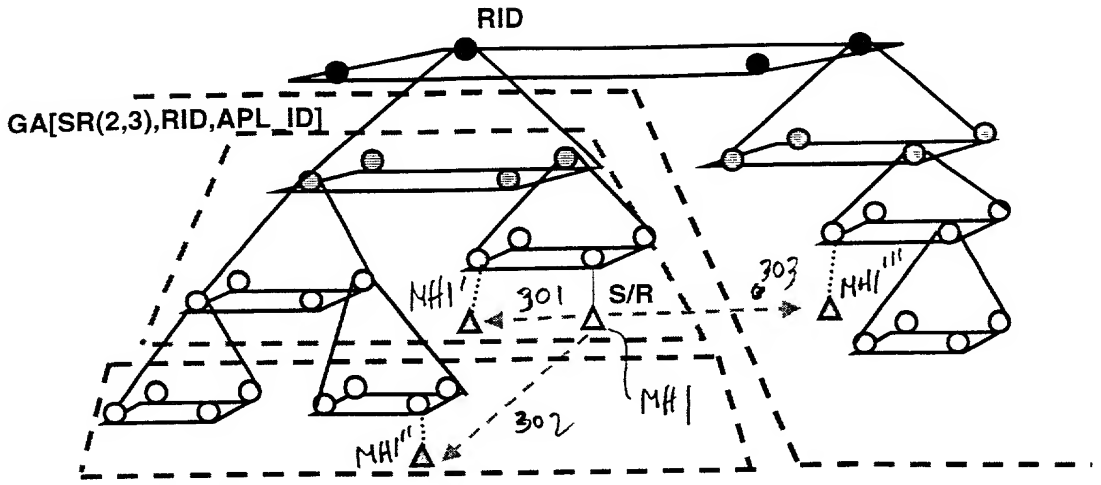

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FIG. 14

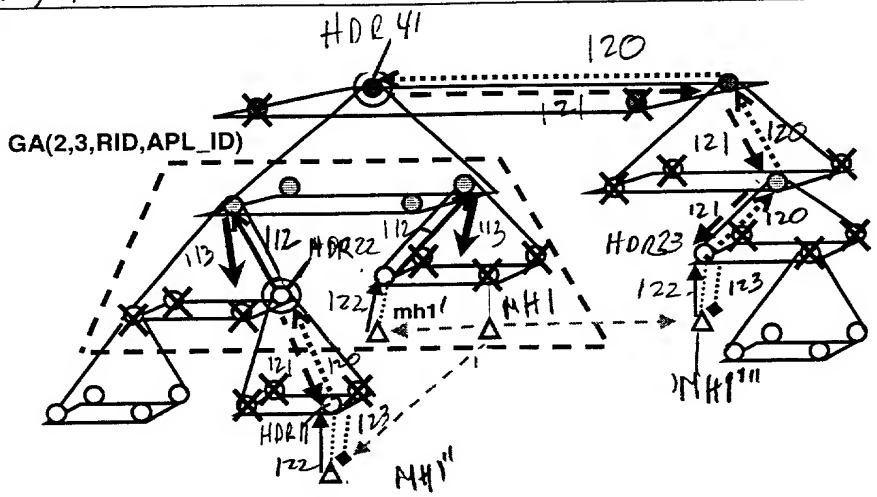

FIG. 15

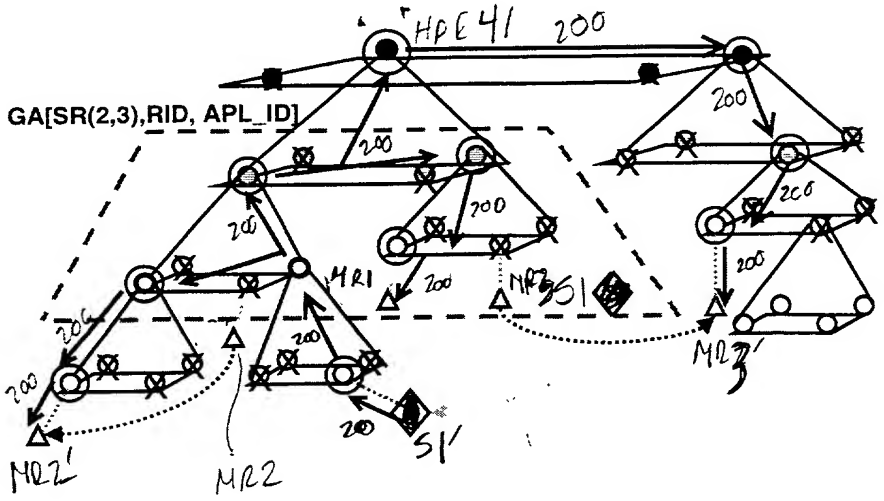
HDE41
200
GA[SR(2,3),RID, APL_ID]
MR1
MR3
S1
MR2'
MR2
S1'
MR3'

FIG. 16

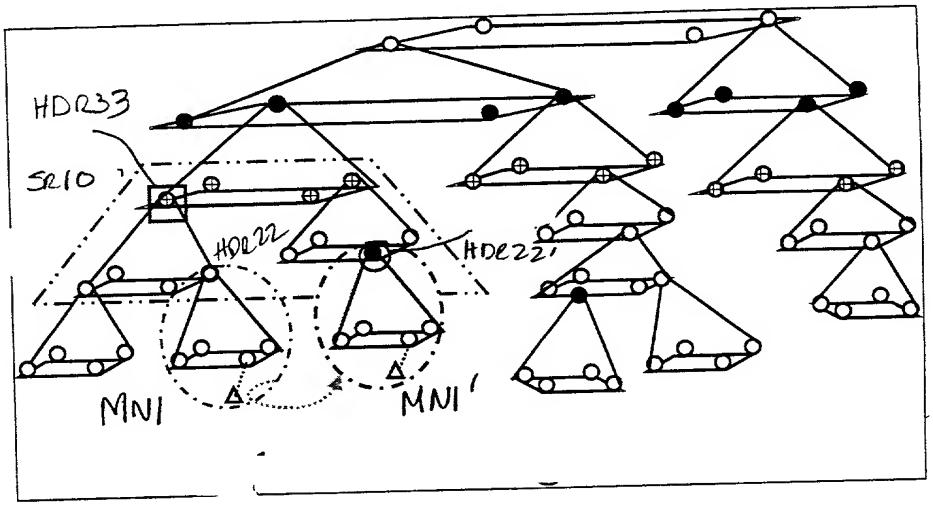
HDR33
SR10
HDE22
HDE22'
MN1
MN1'

FIG. 17

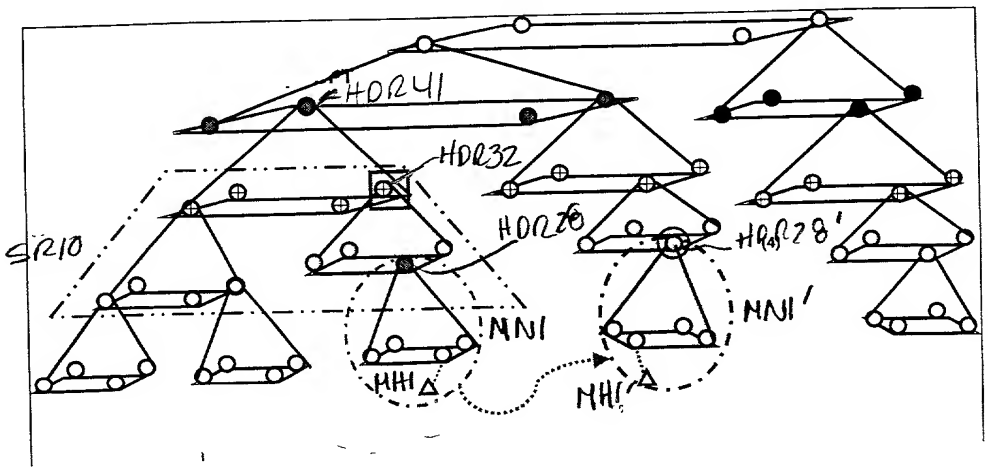

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FIG. 18

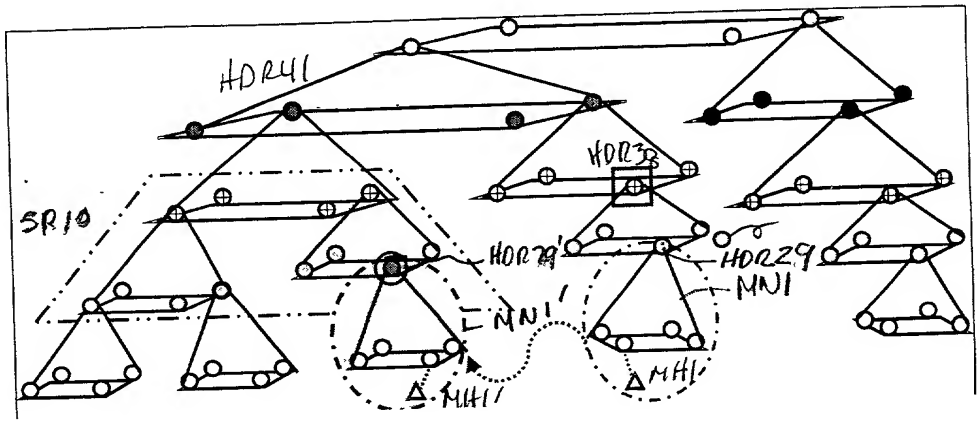

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FIG. 19

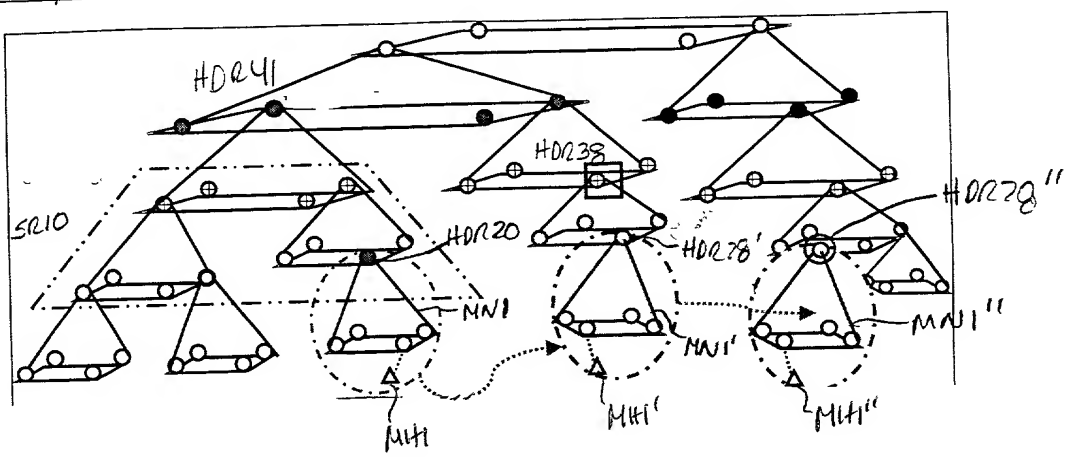

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FIG. 20

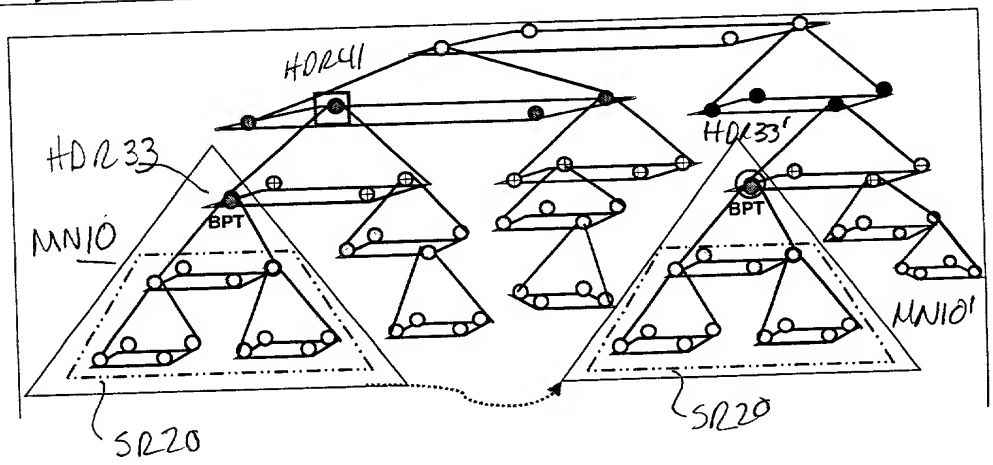

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FIG. 21 A

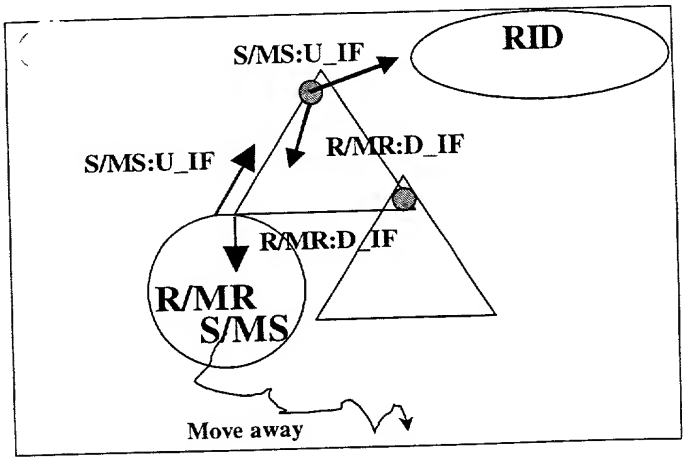

FIG. 21 B

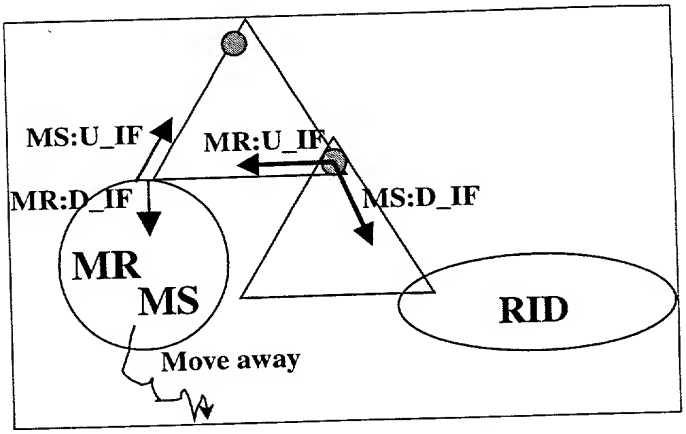

FIG. 21C

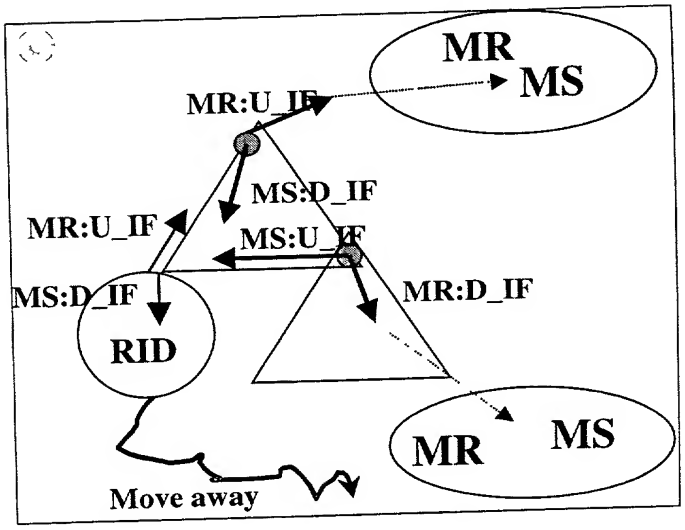

FIG. 22

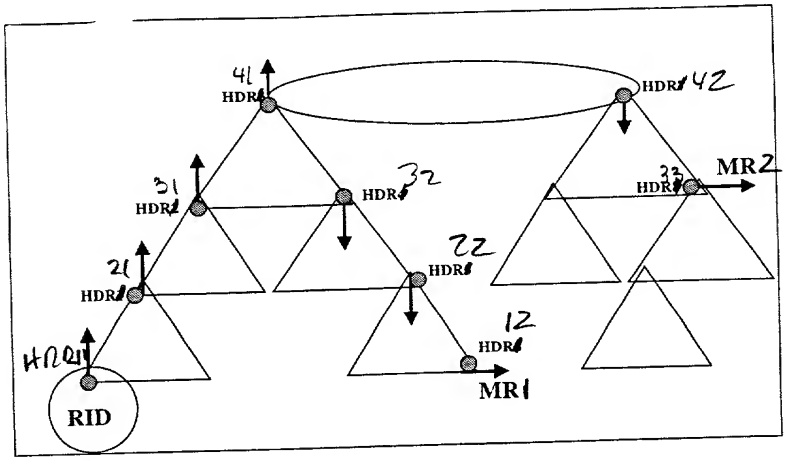

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FIG. 23

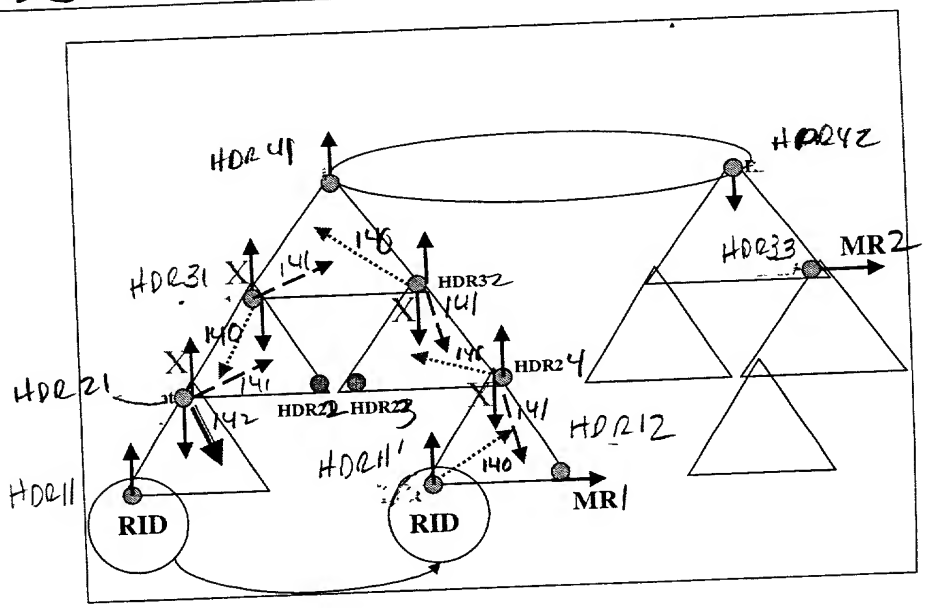

FIG. 24

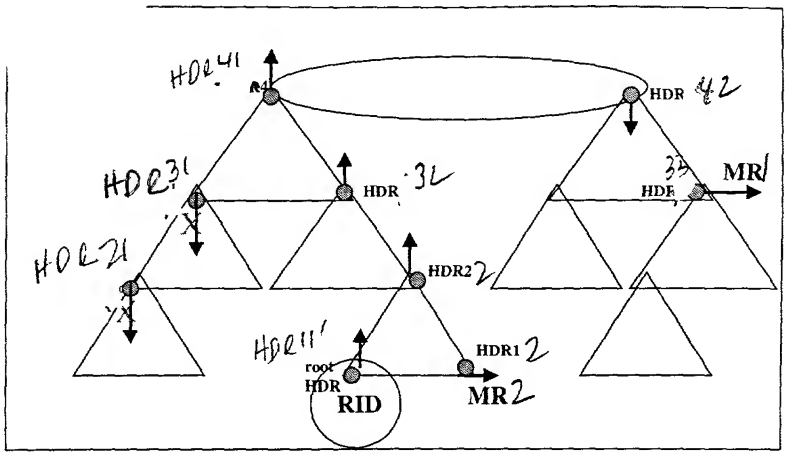
HDR41
HDR 42
HDR31
HDR 32
MR1
HDR21
HDR2 2
HDR11'
HDR1 2
root HDR
RID
MR2

FIG. 25

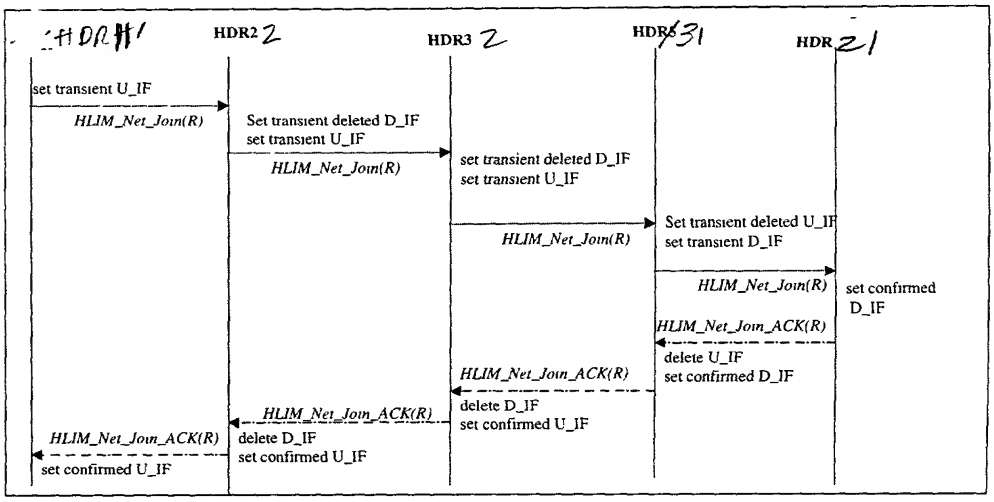
HDR11'
HDR2 2
HDR3 2
HDR31
HDR 21
set transient U_IF
HLIM_Net_Join(R)
Set transient deleted D_IF
set transient U_IF
HLIM_Net_Join(R)
set transient deleted D_IF
set transient U_IF
HLIM_Net_Join(R)
Set transient deleted U_IF
set transient D_IF
HLIM_Net_Join(R)
set confirmed D_IF
HLIM_Net_Join_ACK(R)
delete U_IF
set confirmed D_IF
HLIM_Net_Join_ACK(R)
delete D_IF
set confirmed U_IF
HLIM_Net_Join_ACK(R)
delete D_IF
set confirmed U_IF
HLIM_Net_Join_ACK(R)
set confirmed U_IF

FIG. 26

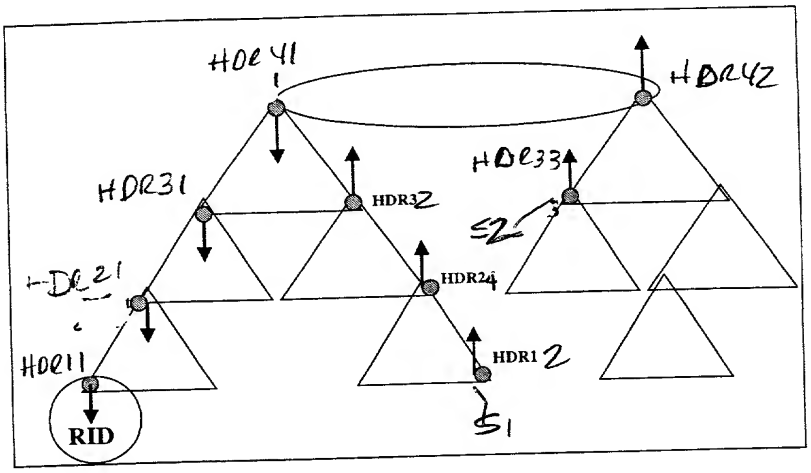
HDR41
HDR42
HDR31
HDR32
HDR33
HDR21
HDR24
HDR11
HDR12
RID
S2
S1

FIG. 27

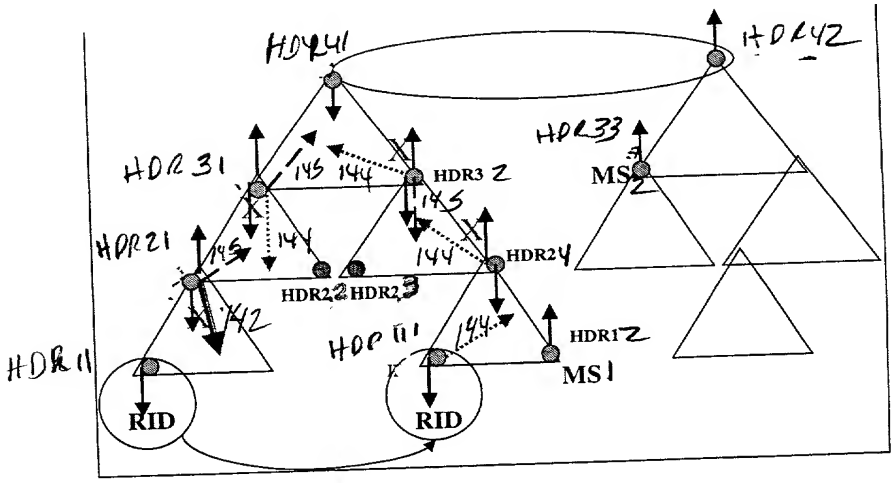
HDR41
HDR42
HDR31
HDR32
HDR33
HDR21
HDR24
HDR22
HDR23
HDR11
HDR12
145
144
142
RID
MS2
MS1

FIG. 28

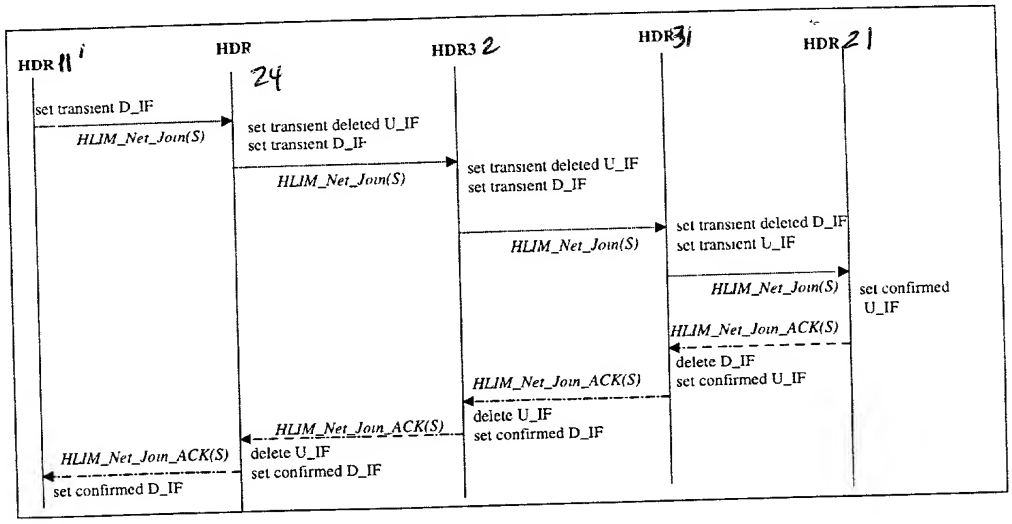
HDR 11
HDR 24
HDR3 2
HDR3 1
HDR 21
set transient D_IF
HLIM_Net_Join(S)
set transient deleted U_IF
set transient D_IF
HLIM_Net_Join(S)
set transient deleted U_IF
set transient D_IF
HLIM_Net_Join(S)
set transient deleted D_IF
set transient U_IF
HLIM_Net_Join(S)
set confirmed U_IF
HLIM_Net_Join_ACK(S)
delete D_IF
set confirmed U_IF
HLIM_Net_Join_ACK(S)
delete U_IF
set confirmed D_IF
HLIM_Net_Join_ACK(S)
delete U_IF
set confirmed D_IF
HLIM_Net_Join_ACK(S)
set confirmed D_IF

FIG. 29

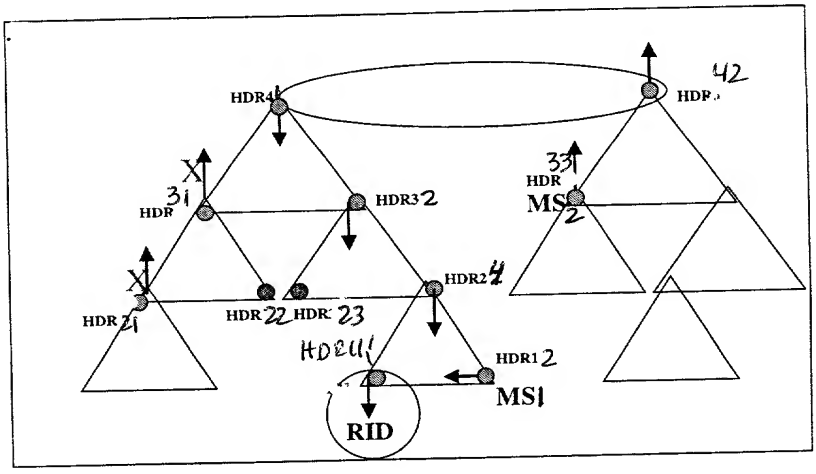
HDR4
42
HDR
31
HDR3 2
HDR
MS2
HDR2 4
HDR 21
HDR 22
HDR 23
HDR11
HDR1 2
MS1
RID

FIG. 30

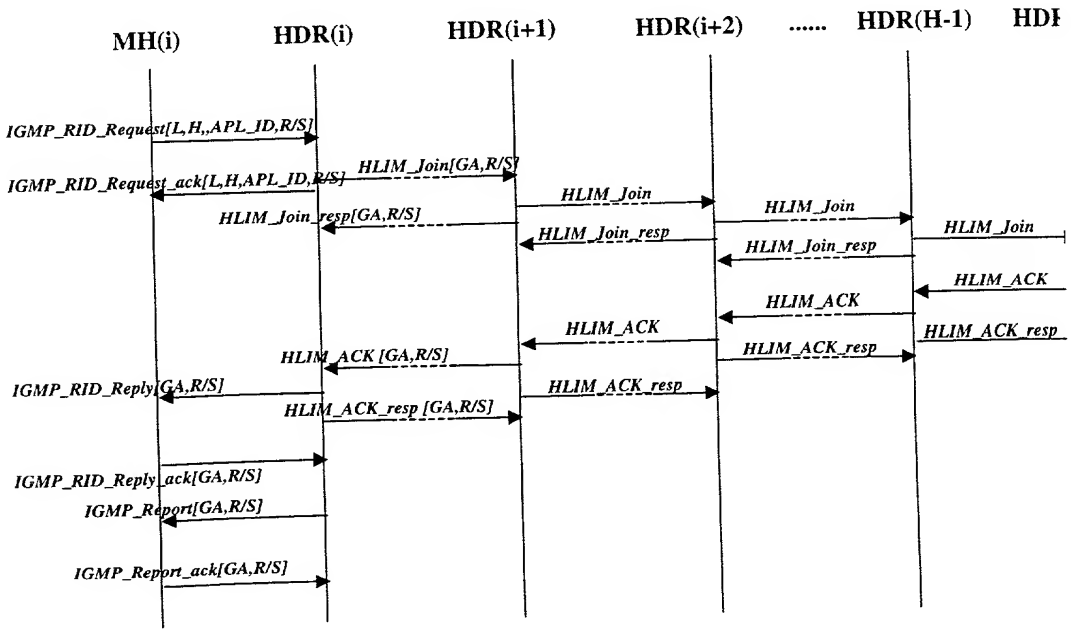

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FIG. 31

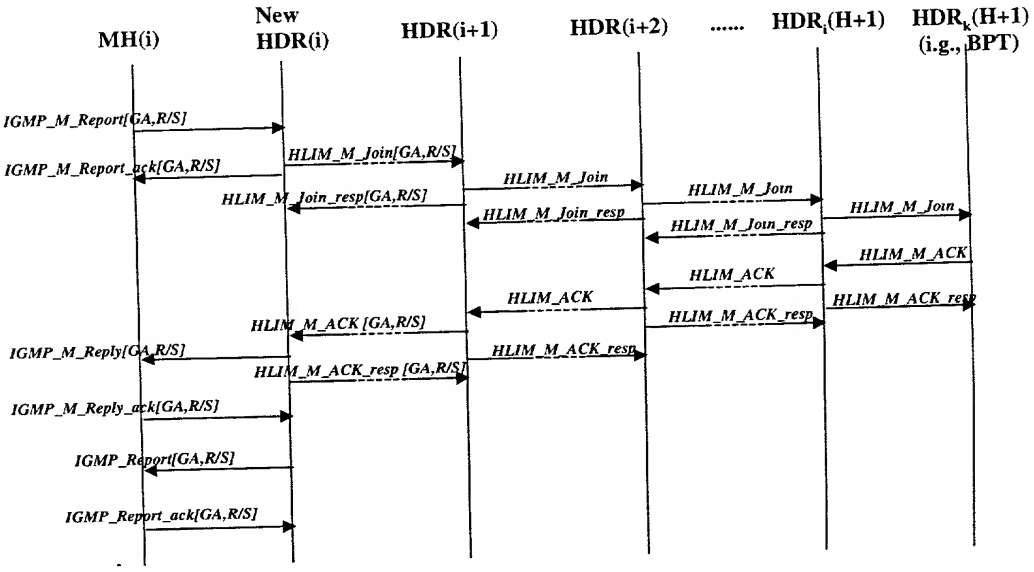

FIG. 32

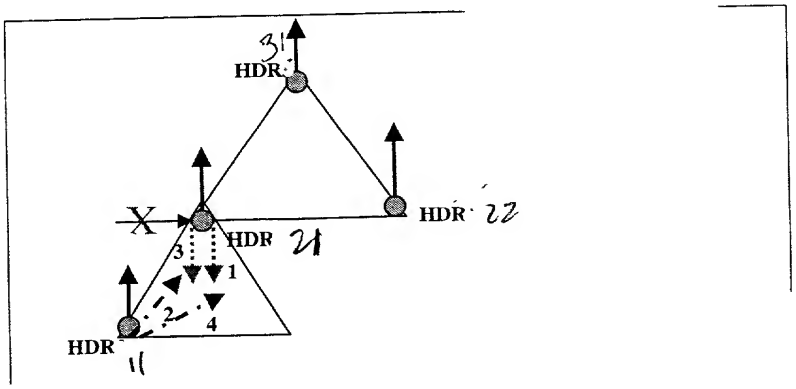

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FIG. 33

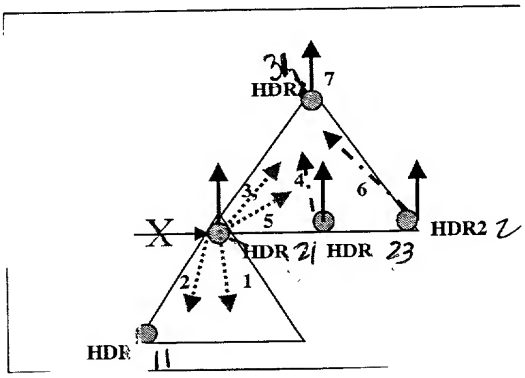

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FIG. 34

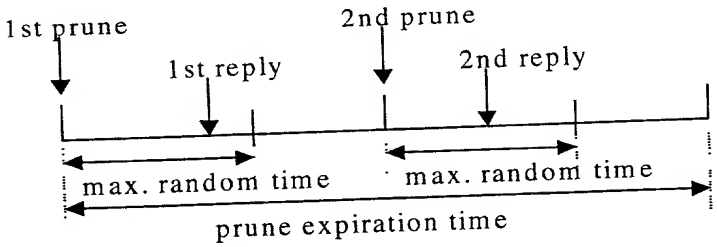

FIG. 35

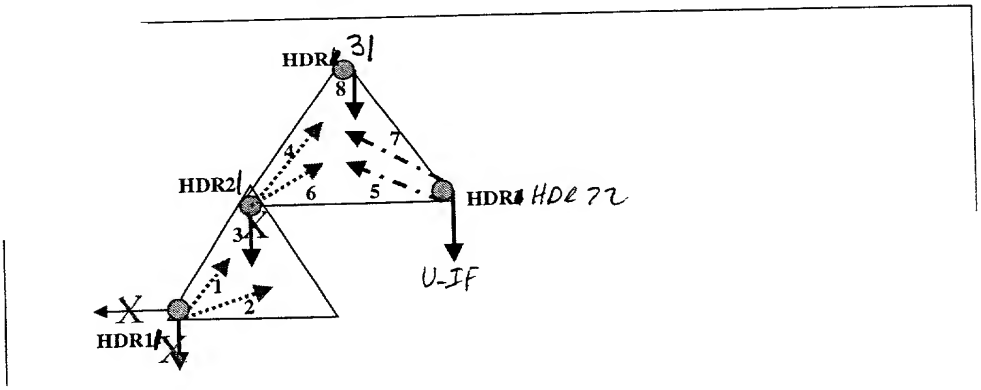

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FIG. 36

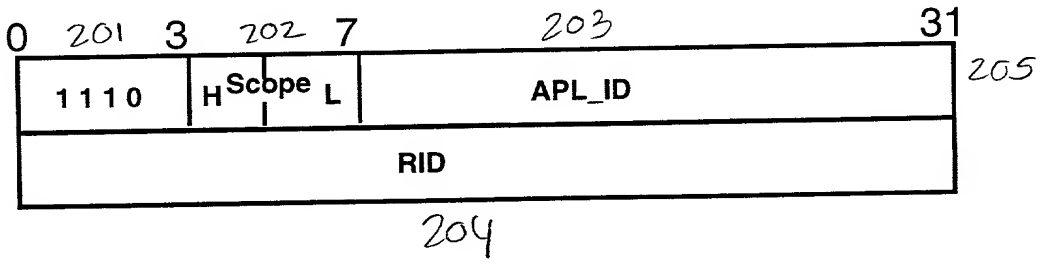

FIG. 37

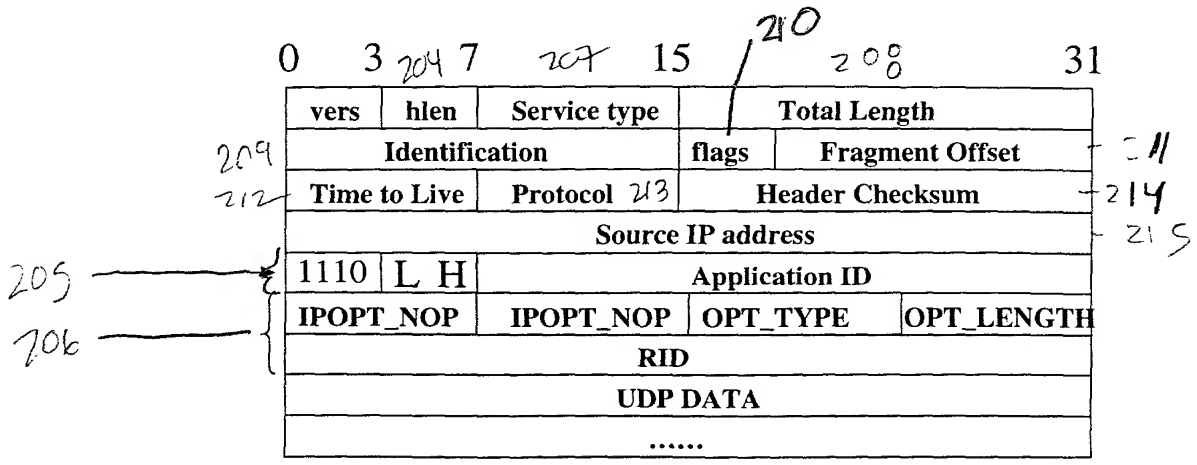

FIG. 38

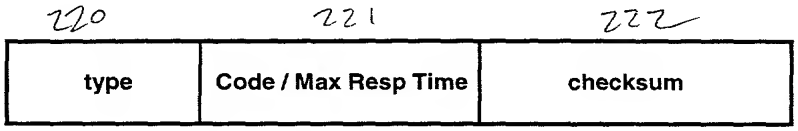

FIG. 39

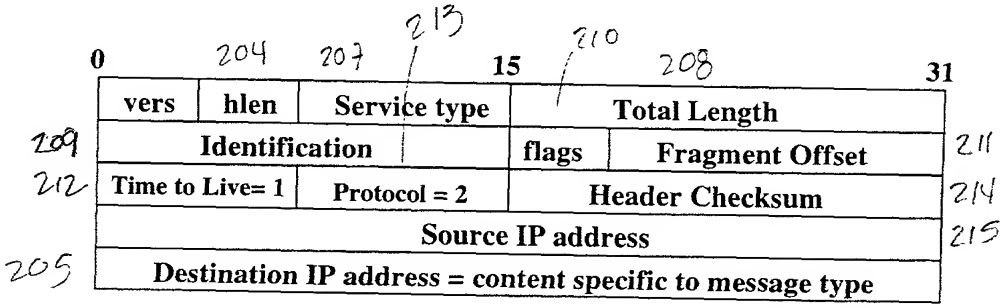

FIG. 40

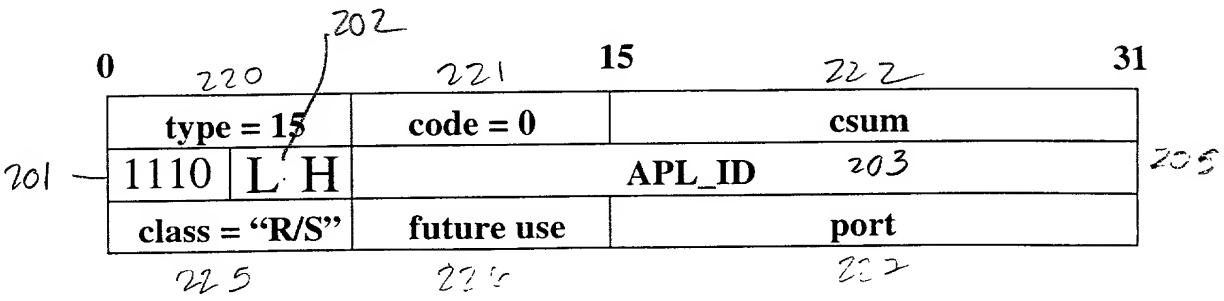

FIG. 41

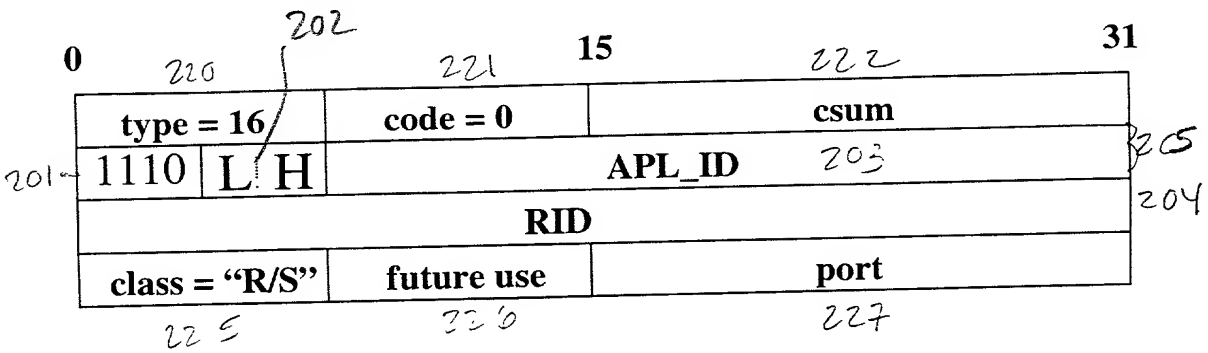

FIG. 42

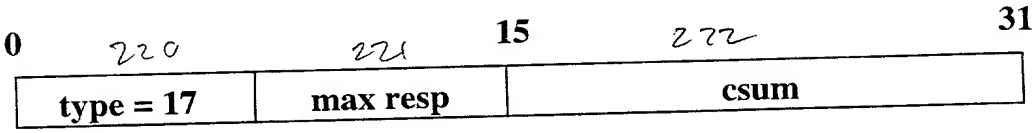

FIG. 43

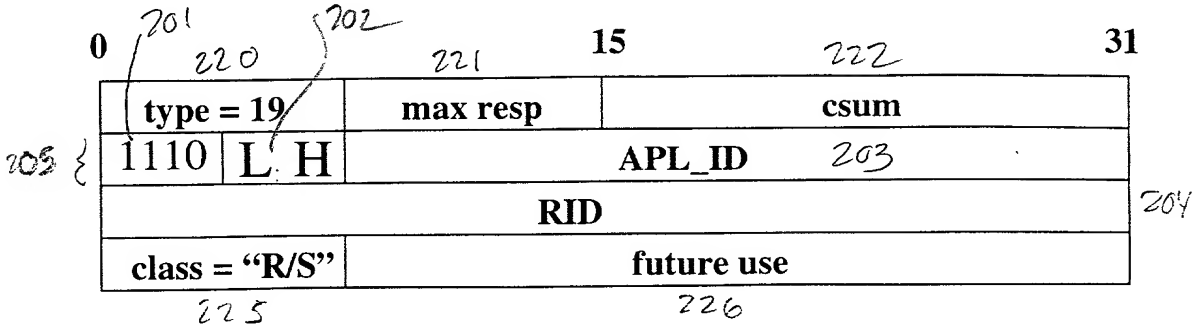

FIG. 44

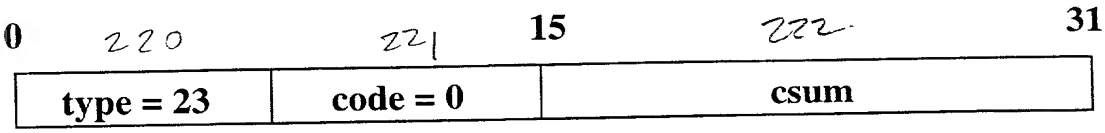

FIG. 45

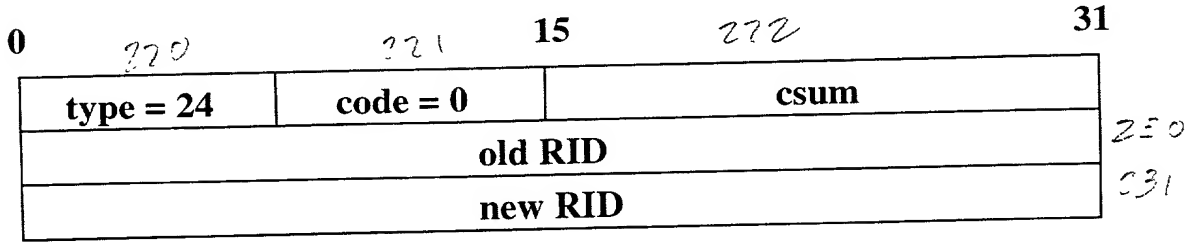

FIG. 46

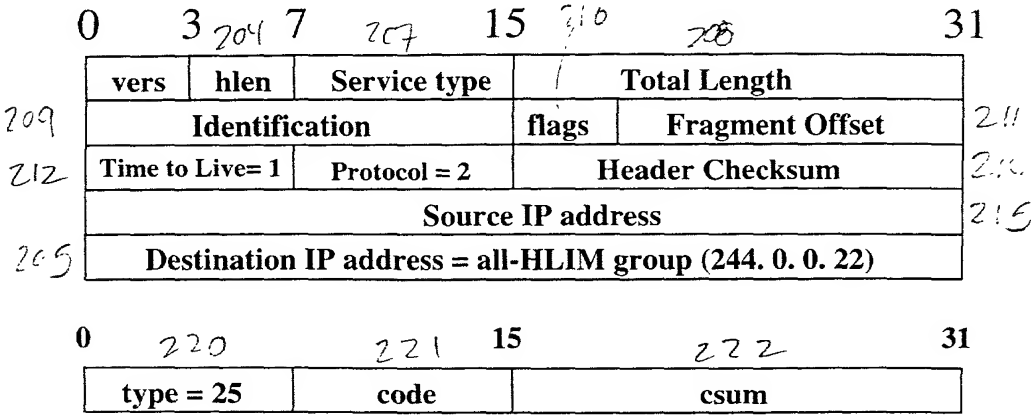

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FIG. 47

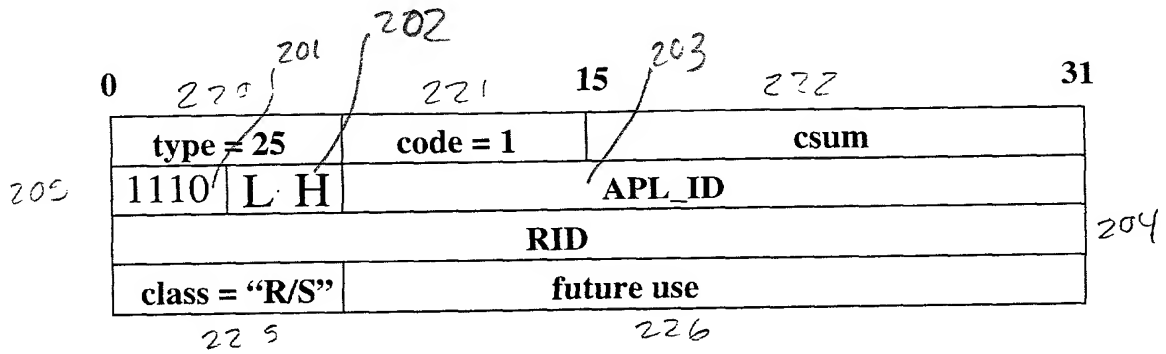

FIG. 48

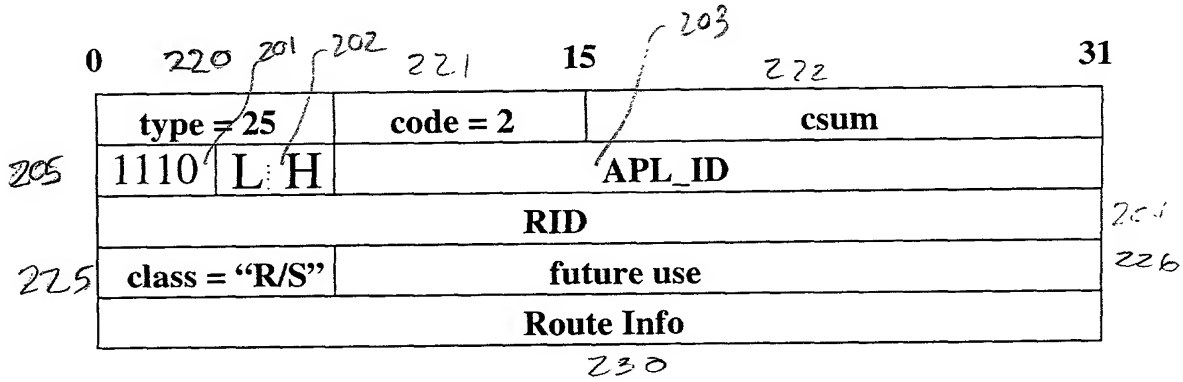

FIG. 49

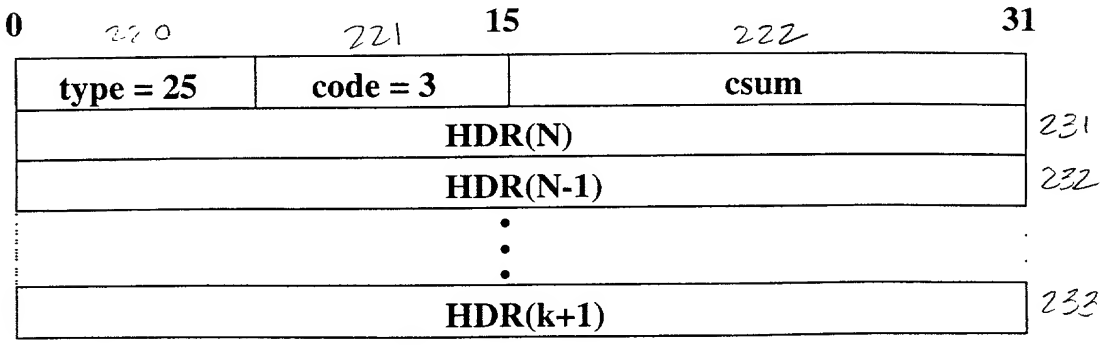

FIG. 50

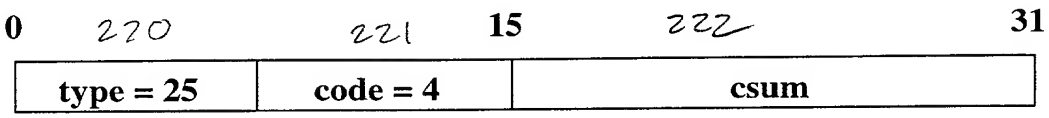

FIG. 51

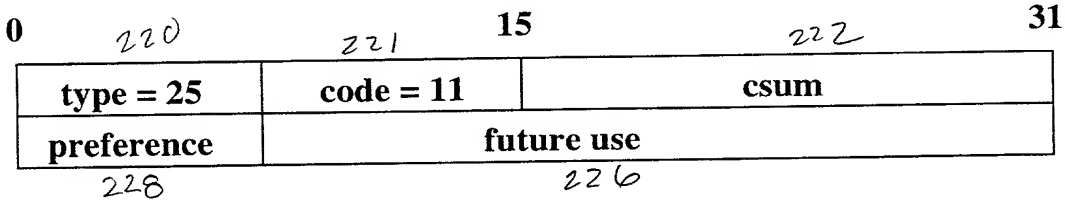

FIG. 52

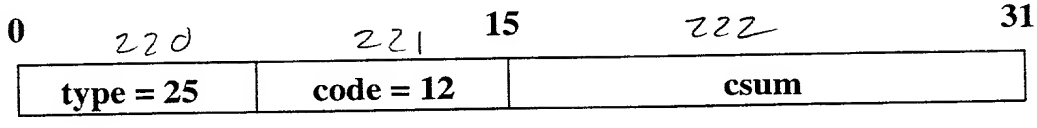

FIG. 53

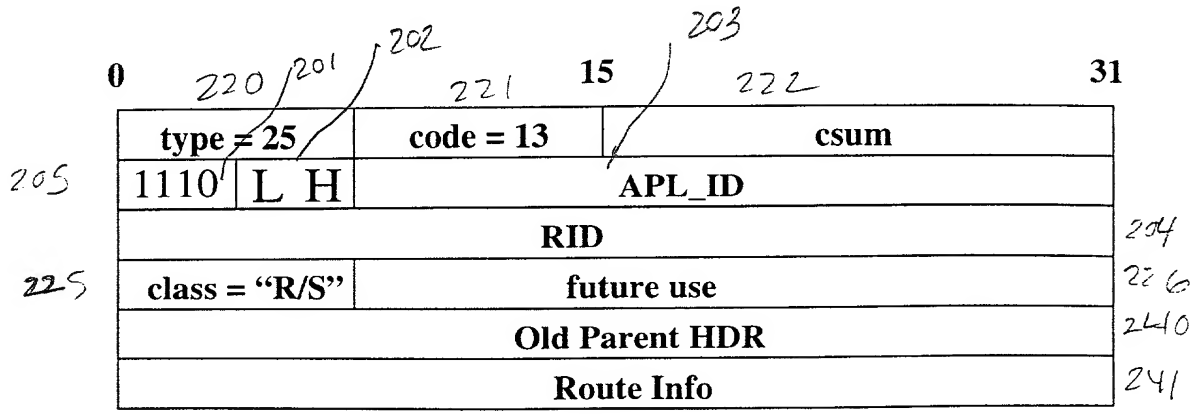

FIG. 54

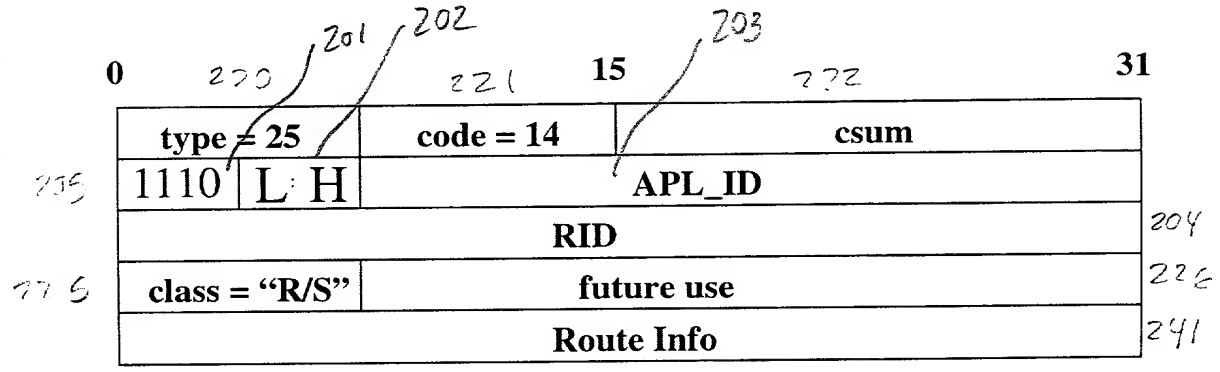

FIG. 55

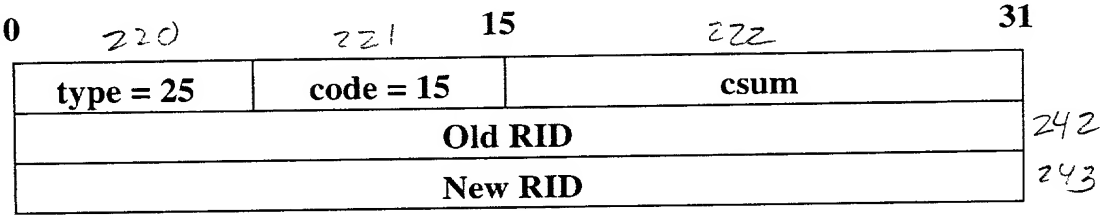

FIG. 56

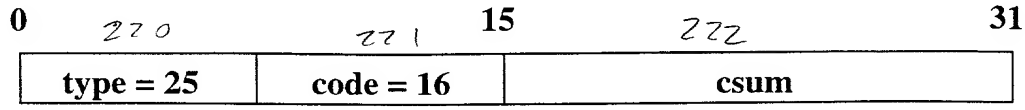

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FIG. 57

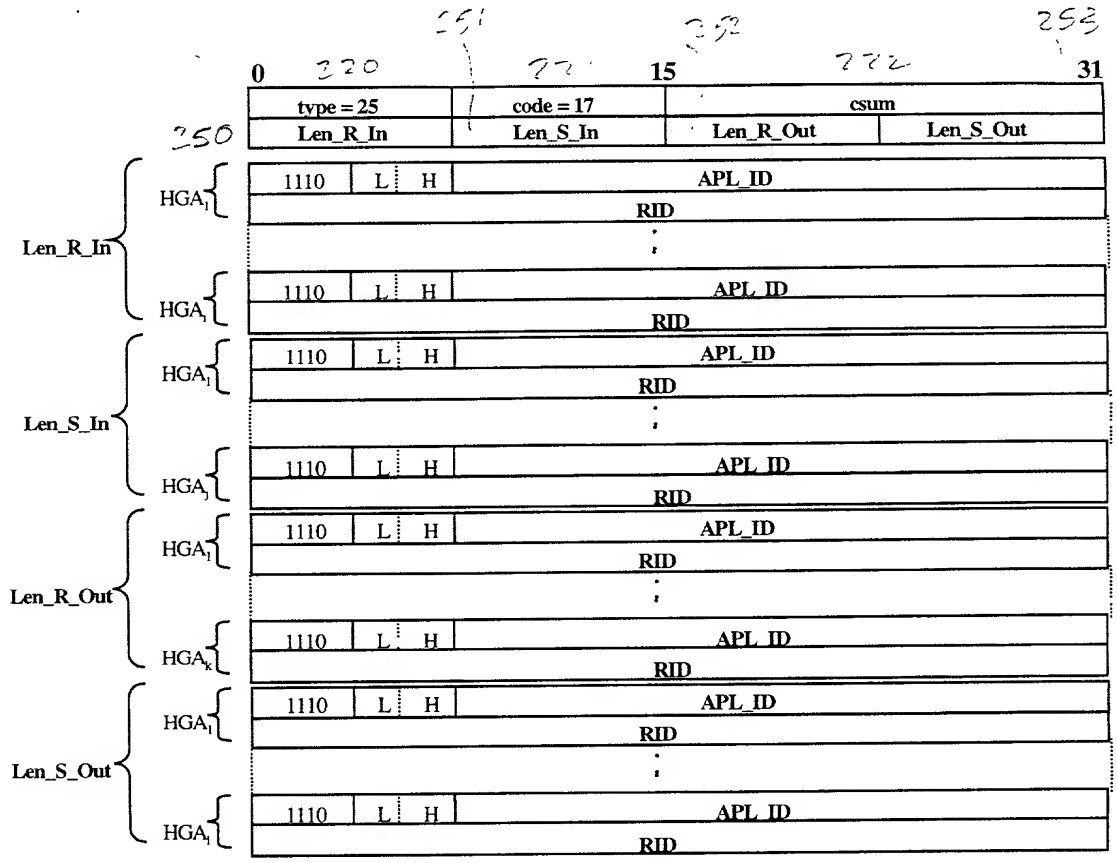

FIG. 58

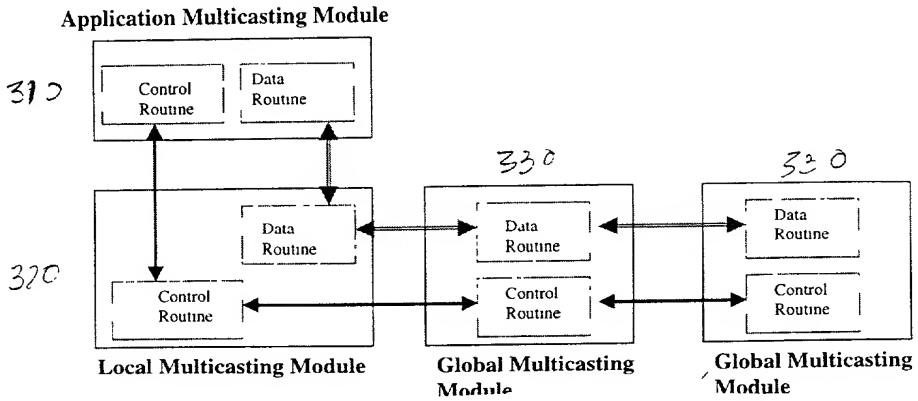

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FIG. 59

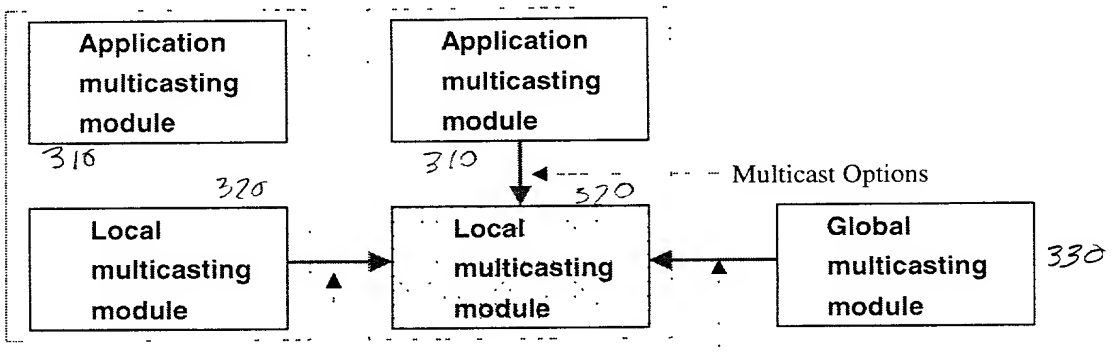


FIG. 60

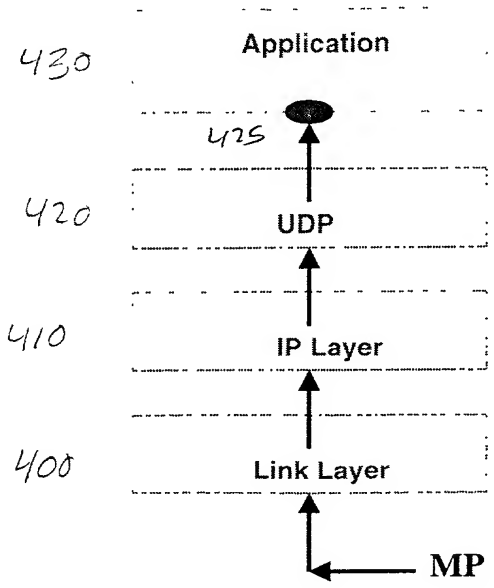

430
Application
425
420
UDP
410
IP Layer
400
Link Layer
MP

FIG. 61

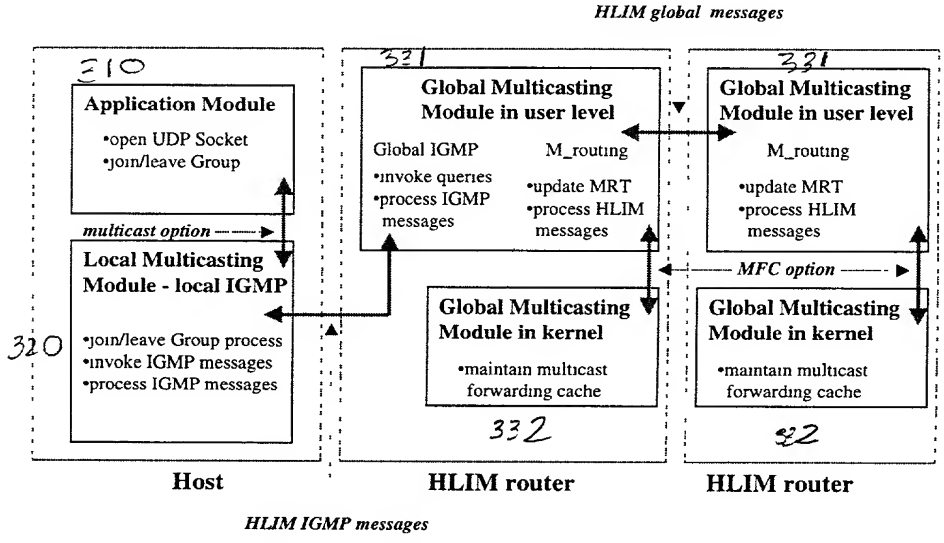

HLIM global messages
310
Application Module
•open UDP Socket
•join/leave Group
multicast option
Local Multicasting Module - local IGMP
•join/leave Group process
•invoke IGMP messages
•process IGMP messages
320
321
Global Multicasting Module in user level
Global IGMP
•invoke queries
•process IGMP messages
M_routing
•update MRT
•process HLIM messages
Global Multicasting Module in kernel
•maintain multicast forwarding cache
332
321
Global Multicasting Module in user level
M_routing
•update MRT
•process HLIM messages
MFC option
Global Multicasting Module in kernel
•maintain multicast forwarding cache
332
Host
HLIM router
HLIM router
HLIM IGMP messages

FIG. 62

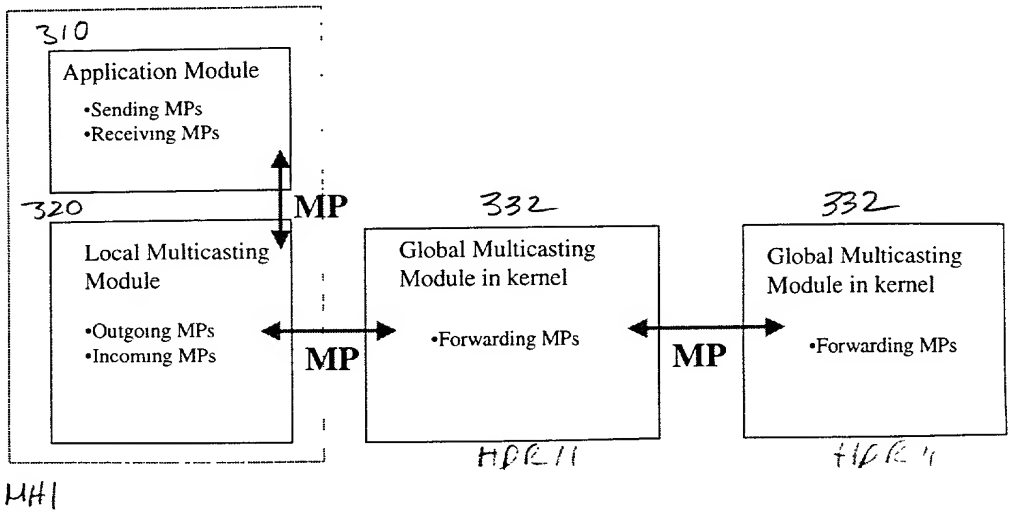

310
Application Module
•Sending MPs
•Receiving MPs
320
MP
Local Multicasting Module
•Outgoing MPs
•Incoming MPs
MP
332
Global Multicasting Module in kernel
•Forwarding MPs
MP
332
Global Multicasting Module in kernel
•Forwarding MPs
HH1
HRR11
HRR1

FIG. 63

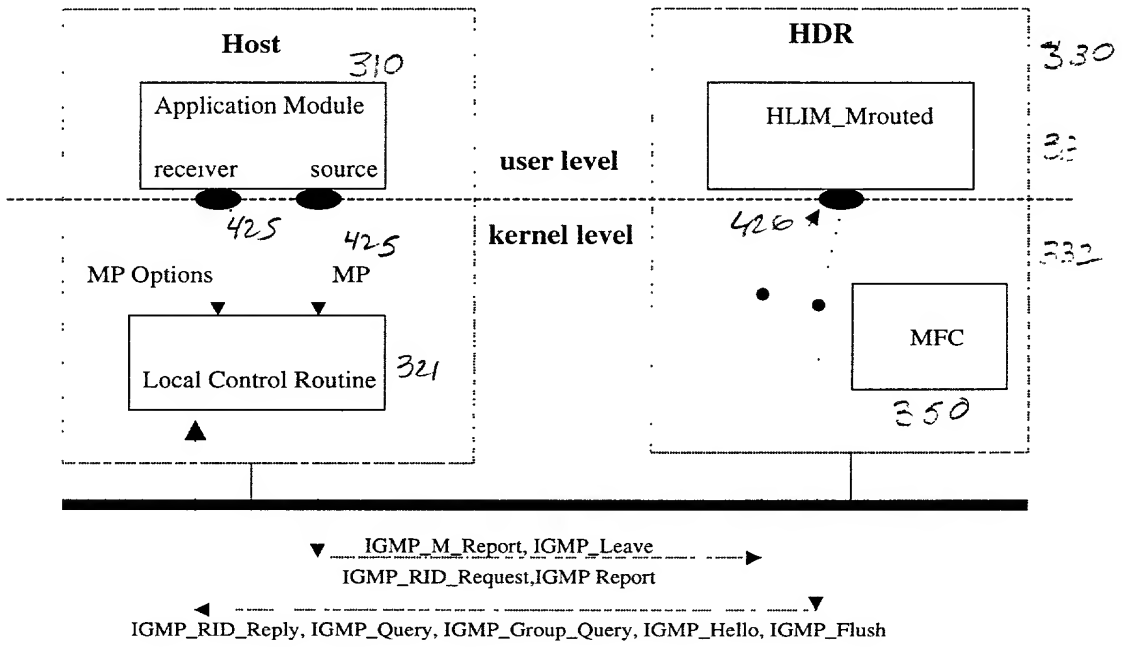

Host
310
Application Module
receiver
source
425
425
MP Options
MP
Local Control Routine
321
user level
kernel level
HDR
330
HLIM_Mrouted
426
MFC
350
IGMP_M_Report, IGMP_Leave
IGMP_RID_Request,IGMP Report
IGMP_RID_Reply, IGMP_Query, IGMP_Group_Query, IGMP_Hello, IGMP_Flush

FIG. 64

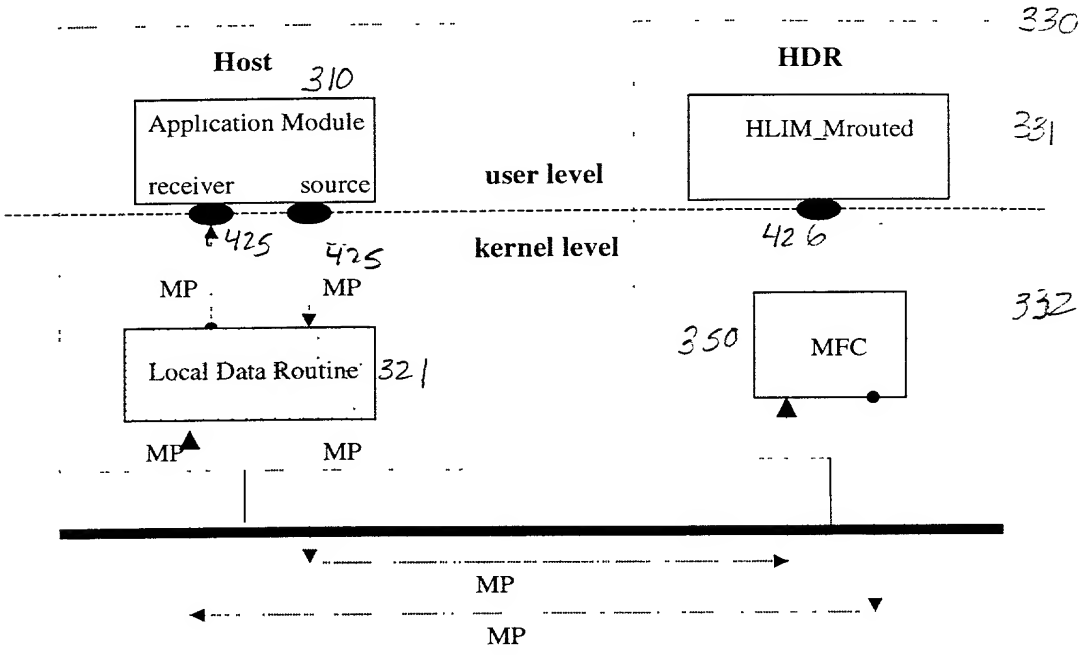

330
Host
310
HDR
Application Module
receiver
source
user level
HLIM_Mrouted
331
425
425
kernel level
426
MP
MP
332
350
MFC
Local Data Routine
321
MP
MP
MP
MP

FIG. 65

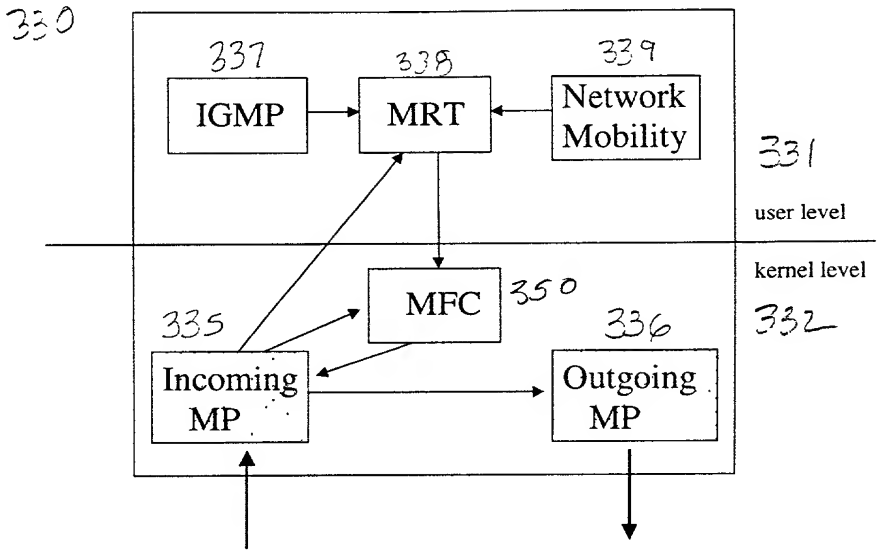

330
337
338
339
IGMP
MRT
Network Mobility
331
user level
kernel level
MFC
350
335
336
332
Incoming MP
Outgoing MP

FIG. 66

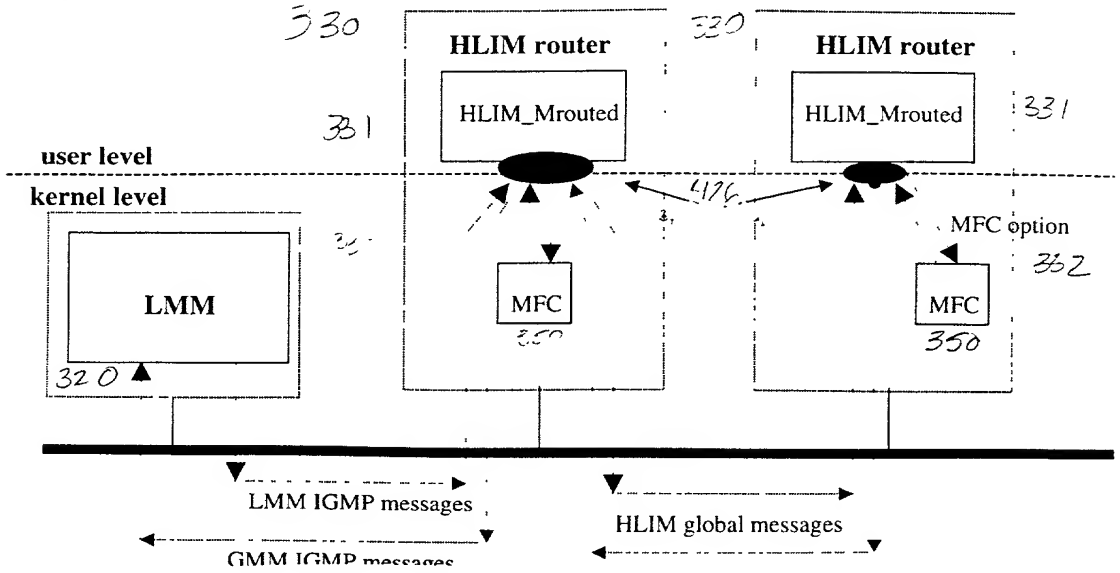
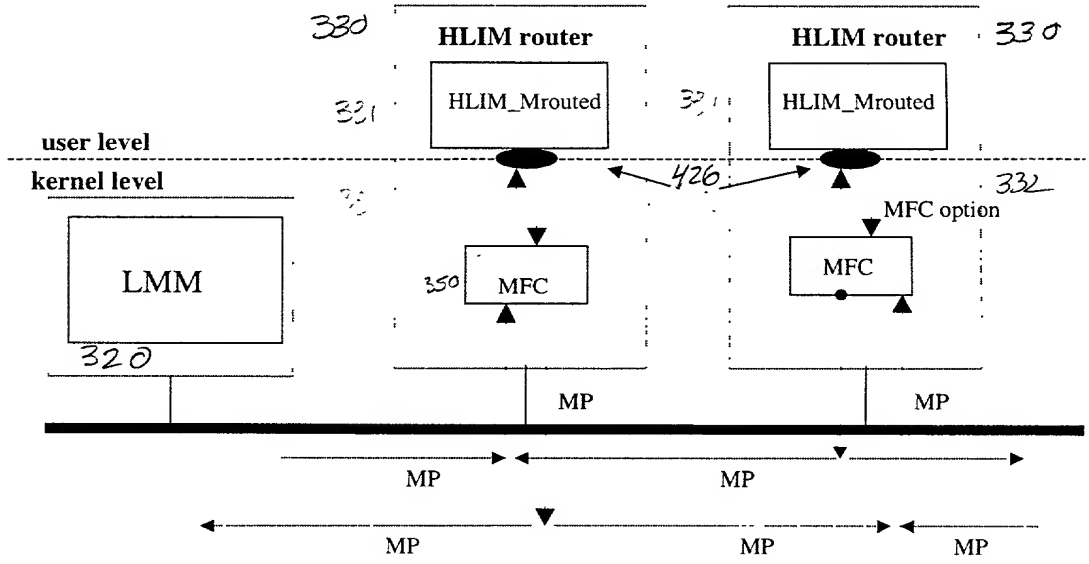

330
HLIM router
320
HLIM router
331
HLIM_Mrouted
HLIM_Mrouted
331
user level
kernel level
426
MFC option
LMM
MFC
MFC
350
350
320
LMM IGMP messages
HLIM global messages
GMM IGMP messages

FIG. 67


330
HLIM router
HLIM router
330
331
HLIM_Mrouted
HLIM_Mrouted
user level
kernel level
426
MFC option
LMM
350
MFC
MFC
320
MP
MP
MP
MP
MP
MP